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THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

110th Session.] FRIDAY, DECEMBER 18, 1863. [No. 578. Vol. XII.

Announcements by the Council.

Art-Workmanship.

The works submitted in competition for the Prizes offered by the Society will remain in the Great Room till Monday next, the 21st inst., after which they will be removed to the South Kensington Museum.

Mr. Richard Redgrave, R.A., Mr. Digby Wyatt, M.R.I.B.A., and Mr. John Webb, the judges appointed by the Council, have made the following awards :—

1. *Modelling in Terra Cotta, Plaster, or Wax.*

(*a.*) The Human Figure in bas relief, after Rafaelle's design of the "Three Graces."—23 works sent in.

1st Prize of £10 to J. Griffiths, 51, Coleshill-street, Eaton-square.

2nd Prize of £5 to A. Cheseneau, 11, Roxburgh-grove, Haverstock-hill.

(*b.*) Ornament in bas relief, after arabesques by Lucas van Leyden, 1528.—8 works sent in.

1st Prize of £5 to C. H. Whitaker, Sheffield-place, Coventry-road, Birmingham.

2nd Prize of £3 to J. Steel, jun., 88, Hanover-street, Glasgow.

2. *Repoussé Work in any Metal.*

(*a.*) The Human Figure as a bas-relief, after Rafaelle's "Three Graces."—3 works sent in.

1st Prize of £10 not awarded.

2nd Prize of £5 to E. Beresford, 47, Green-street, Stepney.

(*b.*) Ornament, after a Flemish salver in the South Kensington Museum, date about 1670.—1 work sent in.

1st Prize of £5 to G. Webster, Woodbank, Walkley, near Sheffield.

2nd Prize of £3 not awarded.

3. *Hammered Work, in Iron, Brass, or Copper.*

Ornament, after an iron German arabesque, about 1520, in the South Kensington Museum.—2 works sent in.

1st Prize of £5 not awarded.

Two 2nd Prizes of £3 each to T. Bailey, 77, King Edward-road, Birmingham, and W. Ash, 7, Martlett's-court, Bow-street.

4. *Carving in Ivory.*

The Human Figure in bas-relief, after a terra cotta ascribed to Luca della Robbia, about 1420, in the South Kensington Museum.—4 works sent in.

1st Prize of £10 to J. W. Bentley, 22, Sherwood-street, Golden-square.

2nd Prize of £5 to "Ricardo" (name not given).

5. *Chasing on Metal.*

(*a.*) The Human Figure, after a reduced copy of Gibson's Psyche.—6 works sent in.

1st Prize of £10 to W. Holliday, 14, Naylour-street, Islington.

2nd Prize of £5 to C. Jacquard, 1, St. George's-road New Kent-road.

(*b.*) Ornament, after a bronze plaque in the South Kensington Museum.—11 works sent in.

Two 1st Prizes of £5 each to G. R. Meek, and R. E. Barrett, at Messrs. Hunt and Roskell's, 26, Harrison-street, Gray's Inn-lane.

Two 2nd Prizes of £3 each to R. Orpwood and G. Gibaud, at Messrs. Hunt and Roskell's.

6. *Enamel Painting on Metal, Copper, or Gold.*

(*a.*) The Human Figure, after Rafaelle's design of the "Three Graces," executed in grisaille.—None sent in.

(*b.*) Ornament in grisaille, after a German arabesque, 16th century.—1 work sent in, but not in accordance with the conditions.

7. *Painting on Porcelain.*

(*a.*) The Human Figure, after Rafaelle's "Boy Bearing Doves," in the cartoon of the "Beautiful Gate."—5 works sent in.

1st Prize of £10 to E. E. Dunn, Eastwood-vale, Hanley, Staffordshire.

2nd Prize of £5 to Thos. Allen, Howard-place, Shelton, Staffordshire.

(*b.*) Ornament, after arabesques by Lucas Van Leyden, 1528.—3 works sent in.

1st Prize of £5 not awarded.

2nd Prize of £3 to J. B. Evans, South-street, Mount Pleasant, Fenton, Staffordshire.

8. *Inlays in Wood (Marquetry, or Buhl), Ivory or Metal.*

Ornament, after a majolica plate in the South Kensington Museum, 1490.—2 works.

1st Prize of £5, not awarded.

Two 2nd Prizes of £3 each to F. Braun, and H. Braun, 15, Cleveland-street, W.

9. *Engraving on Glass.*

Ornament, after arabesques by Lucas Van Leyden, 1528.—None sent in.

10 *Embroidery.*

Ornament, after a German example in the Green Vaults at Dresden.—1 work.

No Prize awarded.

Cantor Lectures.

Courses of Lectures (under the title of "the Cantor Lectures") on the following subjects, will be delivered during the Session :—

The Operation of the Present Laws of Naval Warfare on International Commerce. By G. W. **Hastings**, Esq., Barrister-at-Law.

Fine Arts Applied to Industry. By W. **Burges**, Esq.

Chemistry Applied to the Arts. By Dr. F. **Crace Calvert**, F.R.S.

The third lecture of Mr. Hastings' course will be delivered on Monday, the 25th January, at 8 o'clock, the subjects of which, and of the concluding lecture, will be as follows :—

Contraband; its Nature and Usages.
Capture of Private Property at Sea; present State of the Law as modified by the Declaration of Paris; Arguments for and against its Continuance.
The Foreign Enlistment Act; its Operation on Commerce.

The Michaelmas subscriptions are now due, and should be forwarded by cheque or post-office order, made payable to the Financial Officer, Samuel Thomas Davenport. All cheques and post-office orders should be crossed through Messrs. Coutts and Co.

Proceedings of the Society.

COMMITTEES OF REFERENCE.

Mechanics and Engineering.

This committee met on Friday, the 4th inst., to consider how information might best be obtained on subjects suggested in the Society's new Premium List, and to discuss other topics connected with mechanical and engineering improvements which it might be thought desirable to bring under the consideration of the Society. W. Hawes, Esq., Chairman of the Council, presided, and in opening the proceedings called attention to the subjects embraced under this head for which premiums had been offered by the Society. He first called the attention of the Committee to the prize offered under the will of the late Dr. Fothergill, for the best method of preventing and speedily extinguishing destructive fires, &c., and mentioned that the Society's medals were offered for the most efficient steam fire-engine for land use, and also for the best that was capable of self-propulsion.

Mr. D. K. Clark remarked, that the only satisfactory test of fire-engines was a public trial of their action. One or two trials of that kind had taken place within the last twelvemonths, but it seemed that the conditions required to be more clearly defined than had hitherto been done. He thought further trials were needed. On the subject of smokeless locomotive engines, which was mentioned at a former meeting of the Committee, he believed a new description of engine, modified from the original designs, was being constructed for the Metropolitan Railway. That, however, could hardly be a matter of competition, from the very limited demand there was for that description of fire-engine.

Mr. Mereweather remarked that the trials of fire-engines required to be made under more carefully considered conditions. The actual quantity of water thrown, as compared with the theoretical quantity, was not shown, and the horse-power developed by each engine was not recorded, nor was the power of the boilers accurately defined. It was a trial rather of the skill of the fireman than of the mechanical merits of the engine. He thought conditions might be arranged by which future trials could be made more satisfactory. The amount of property that could be saved by the use of steam fire-engines even in their present state was enormous, and he regretted they were not more generally in use.

Mr. Blackie thought any theoretical statements on this subject apart from actual experiment would be useless.

Mr. John MacGregor regarded this subject as analogous to that of life-boats. Mere description without practical test would be valueless.

Mr. Mereweather remarked that the relations of the weight and power were the main considerations in these engines.

Mr. Davison, upon the general subject of preventibility of fires, advocated a system of heating public buildings by means of hot air propelled by fan machinery, which might be modified to suit ordinary dwellings.

Mr. John Grantham submitted the subject of the safety of ships from fire as one worthy of the consideration of this committee. Mr. Milner of fire-proof safe celebrity, had patented a fire-proof bulkhead for ships, a very excellent thing, but little attention had been paid to it. Another means of making a fire-proof bulkhead was the having two thicknesses of iron, and the interior filled with water. There might be two or three such bulkheads in a ship. In the case of the *Sarah Sands*, the bulkhead was the means of saving the ship.

Sir Edward Belcher, reverting to the subject of heating by air, mentioned the successful use of Perkins's hot-water tubes on board the *Terror* during the Artic expedition. He advocated the use of compartments, both air tight and water-tight, as giving a ready means of extinguishing fires. He, however, considered it a mistake to use water at all to put out a fire on board ship. He had formerly set the men to put out fire with their jackets, and if the rigging caught fire the marines blew it out with their muskets.

Mr. Blackie remarked that steam was the best-known extinguisher of fire, and in the case of steamers was always available for that purpose if the necessary arrangements were made.

Mr. Varley agreed with the suggestions made with regard to compartments in ships.

A letter was then read from Mr. Wise, referring to steam boilers, and describing one newly invented, which he thought possessed many advantages.

A discussion then ensued as to the future course of proceedings by the committee.

CANTOR LECTURES.

The Operation of the Present Laws of Naval Warfare on International Commerce. By G. W. Hastings, Esq.

2nd Lecture, Monday, Dec. 14.—The Law of Blockade.

Mr. Hastings commenced his second lecture by a recapitulation of his first; and then proceeded to explain what was the existing law on the subject, differing as it did in this country and others. There were three admitted requisites for enforcing a blockade by condemnation; the first, that the blockade shall be actually established; the second, that knowledge of the fact shall have been communicated to the parties against whom the law is put in force; the third, that the blockade shall have been violated. With regard to the first point, French publicists held that the blockade must be enforced by an adequate number of ships stationary off the port, and so near to each other as to cause manifest and immediate danger to the vessel attempting an entrance. Hautefeuille, a living writer of great ability and acuteness, though unfortunately biassed in some of his opinions by his excessive prejudice against this country, had advanced the doctrine that the ships so stationed ought to be so near that their fires would cross; and he based this doctrine on the principle that no state has any right to exercise a prohibitory jurisdiction over any portion of the sea unless it has reduced that portion into its own possession. England had never admitted the French view of the law on this point, which was endeavoured to be forced on her by the armed neutrality: and in the convention of 1801 she only assented to this enunciation of the law—that the blockade, to be effectual, shall be maintained by vessels stationary off the port, *or* sufficiently near, &c.; a difference of a word only, and of a very little word, but one which was vital to the whole question. By this qualification England had retained the right of blockading by a cruising squadron. The stipulation in the Declaration of Paris, 1856, by which it was declared that blockades must be effectual, was aimed at paper blockades, and did not substantially alter, if it altered at all, the English view of the law. Mr. Hastings read the letter of Earl Russell to Mr. Mason, the Commissioner of the Confederate States, in which this point was stated very clearly, and which must be taken as a declaration of the opinion of the British Government as to the construction of the Paris Declaration. With regard to the second requisite—notification—the French law again differed from our own. The French required that actual notice shall have been given to the neutral vessel approaching the port of the existence of the blockade; and their practice was that such notice shall be entered in the ship's log, or endorsed on her papers. In 1849, when France was blockading the ports of the Argentine Confederation, the *Louisa* was captured for breach of the blockade; and was subsequently released by the French Prize Court, on the ground that the existence of the blockade, and a general notice of it, were not sufficient, and that the blockading force was bound to have given actual notice to the *Louisa* herself. On the other hand, the English authorities held that a public notification, or notice of the blockade communicated to the Government of the country to which the neutral vessel belongs, was sufficient for condemnation; and they carried this constructive notice even further, and held that it might be given by notoriety. After alluding to the judgment in the case of the *Francisca* during the late Russian war, Mr. Hastings said that with regard to the third requisite—that of violation of the blockade—it might take place either actually through the blockading force, or in intention from the moment the vessel quitted her port. In either case she might be seized, and condemned on sufficient evidence. With regard to the existing blockade of the Southern ports in America, Mr. Hastings thought there could be no doubt that it was good and effectual according to English principles, whatever it might be in the extreme views of continental publicists; and we were clearly bound to observe it, whatever temporary suffering and embarrassment it might cause to this country. Mr. Hastings then proceeded to consider the effects produced on international commerce by the existing law of blockade, and pointed out the fearful injuries which it was liable to inflict on neutral and innocent parties, now that the whole world was bound together by such close commercial ties, and nations made dependent on each other for the supply of raw material and food. Whether commercial blockades ought to be abolished, was a subject on which great difference of opinion existed, especially with reference to the naval interests of England; but the question must present itself to the minds of most whether, as a fact, it would be possible to continue them with effect, in the face of the altered and altering circumstances of Europe; railways and electric telegraphs making it no longer possible to close up the export and import trade of any country possessing a neighbour with sea-ports.

Fifth Ordinary Meeting.

Wednesday, December 16th, 1863; Edwin Chadwick, Esq., C.B., in the chair.

The following candidates were proposed for election as members of the Society:—

Adams, Thomas, 5, Alfred-terrace, Spa-road, Bermondsey, S.E.
Burn, Charles, 3, Middle Scotland-yard, Whitehall, S.W.
Byron, Thomas, Wolverhampton.
Dart, Richard, 12, Bedford-street, Covent-garden, W.C.
Flower, Charles Edward, Stratford-on-Avon.
Harcourt, Colonel Francis Vernon, 5, Carlton-gardens, S.W., and Buxted-park, Uckfield.
Moon, William, F.R.G.S., 104, Queen's-road, Brighton.
Rood, John Yeoman, Compton-street, Soho, W.
Simons, William, London Works, Renfrew, N.B.
Soul, Matthew Augustus, 3, Leadenhall-street, E.C.
Spode, J., Hawkesyard-park, near Rugeley.
Tasker, William, Halifax.
Wilson, Robert H. C., 12, Wilson-st., Gray's-inn-rd., W.C.

And as Honorary Corresponding Member,

Coomàra-Swamy, Mutu, Mudeliàr. Ceylon.

The following candidates were balloted for and duly elected members of the Society:—

Atkinson, George, 2, Highbury-park, N.
Baker, Edward, 36, Great Ormond-street, W.C.
Baring, Thomas, M.P., F.R.S., 41, Upper Grosvenor-street, W.
Blackburne, Rev. Thomas, Club-chambers, 15, Regent-street, S.W.
Buckland, Wm. John, Drummond-chambers, John-street, Adelphi, W.C.
Cook, Henry, Cannon-road, Brighton.
Engel, Louis, 31, Grosvenor-street, W.
Eykyn, Roger, 13, Upper Grosvenor-street, W.
Hammond, C. D., M.D., 11, Charlotte-street, Bedford-square, W.C.
Heaton, Charles, Bradford-house, Bolton.
Hill, John, 19, Tavistock-square, W.C.
Holtum, William, Church-street, Walmer.
King, William D., 148, Queen-street, Portsea.
Lewal, Gabriel, 5 and 6, Philpot-lane, E.C.
Martin, Henry A., 64, Berwick-street, Oxford-street, W.
Robinson, Vincent J., Douglas-villa, Carlton-hill, N.W.
Rogers, E. S., Victoria Oil Works, Collyhurst-road, Manchester.
Schiele, C., 2, Clarence-buildings, Booth-street, Manchester.
Sturman, Edward Albert, Camden-house, Sydenham-park, S.E.
Weatherley, Christopher, 39, High-street, Wapping, E.
Yates, W. S., Stamford-street, North-street, Leeds.

AND AS HONORARY CORRESPONDING MEMBER.

Kelaart, William Casper, Trinidad.

The Paper read was—

ON THE ECONOMIC VALUE OF FOODS, HAVING SPECIAL REFERENCE TO THE DIETARY OF THE LABOURING CLASSES.

By Dr. Edward Smith, F.R.S., Assistant-Physician to the Hospital for Consumption, Brompton.

Preliminary Observations.

The subject of dietary, although in a limited sense a popular one, is not considered with serious attention either by the thinking classes and their exponent, the press, or by the great masses of the population. Everyone, in appealing to his own experience, is conscious of what diet suits him; every housewife knows what is the best arrangement of food for her household, and every governor of a prison or of a workhouse is confident that the dietary under his control is the best that could be arranged, although there are several hundreds of them, and most of them differ from each other. Hence, when everybody knows all about the subject, and much more than anybody can tell them, what wonder that so little progress is made either in the science or practice of dietary, or that auditors for the most part come in the expectation of hearing their own opinions confirmed. And no doubt there is much truth in the knowledge derived from personal experience and general observation; its defect lies in the absence of any large guiding principle, and in the imperfect, or, perhaps erroneous, deductions which are drawn from it.

At this point, however, exact scientific knowledge should be allowed, if it exist, to aid general observation and to give sounder bases for the conclusions which may be drawn—to render exact and logical that which must otherwise be at the best approximate and probable. But scientific knowledge is necessarily of slow growth, and in this country especially, where scarcely any provision is made for its pursuit, must be attained only as the result of great personal labour and immediate sacrifice, and hence science has not lent that aid which the need of the subject demands. Indeed, almost all that we know has been derived from our own generation, and even now we have more knowledge to enable us to pull down than to build up.

However, the world is under the greatest obligations to chemists, and particularly to Baron Von Liebig, for increasing knowledge, for definitely directing knowledge, and for wide generalizations upon this subject; and now that physiology is lending her aid to chemistry, and there are those who make original researches upon this subject their especial study, we are perhaps not unprepared to treat some of the questions involved in that of dietary upon a sound and final basis.

I have undertaken to treat of that part of the subject which refers to the economic value of foods, but in especial reference to a class of persons not one of whom is present, and to not one of those present can it personally be of much importance. The desirability of a knowledge of the cheapest food will be regarded very differently by different classes, as the subject in debate may be whether for dinner there shall be turtle soup or ox-tail soup, or whether it shall be dry bread or bread and dripping. The class who will discuss the first question may be left to their own discretion, for if they should err it would simply lead to waste, which from their abundance they can afford, but the class to whom the latter is a serious matter of debate demands all our consideration. It is because the latter represent in a somewhat exaggerated degree the great mass of our countrymen, and therefore that my subject is a national one, that I bring it forward here. Perhaps no persons are more ignorant on this question than the well-fed class (as to none is it of so little moment), but the well fed class is the influential one in relation to those below it, and as to this lower class the subject is of vast importance, it is the duty of the higher to make themselves acquainted with the knowledge and to communicate it to others. Governments in constitutional countries are said to be behind public opinion, and not to move until urged on by a generally acknowledged public want. But on this matter our own government is in advance of the people, for they have instituted, for the first time in this or any other country, a scientific inquiry into the exact dietary of the great masses of our countrymen, obtaining, in fact, the national dietary—and have already issued information upon the subject of this paper in the 5th report of the Medical Officer of the Privy Council. Hence, I trust the subject will be considered to have its proper place here—before the largest society of thinking men in this kingdom.

Bases of Economical Value of Foods.

The economic value of foods depends upon two circumstances, viz.: the price paid for them, and the nutriment which can be obtained from them; and in reference to each I will offer a few preliminary observations. As to the first, I remark that as a rule, the price of all kinds of food, except vegetables, milk, and bread, is greater in our small villages and hamlets than in towns, and that in large towns, and particularly in London, food may be purchased at the lowest possible price in this country. In villages the tea is dearer than in towns by from ½d. to 1d. per ounce; sugar by ½d. to 1d. per lb.; flour by 2d. to 4d. a stone; bacon, 2d. a lb.; meat, 1d. to 2d. a lb. for the cheaper joints; butter, 2d. to 6d. per lb. In reference to some of these the difference of price is absolute, but as to others it depends upon the fact that only one quality can be purchased, and with regard to the same food there is no correspondence between their nutritive and marketable values. Thus the cheapest joints of meat, as the breast of mutton, which are sold at so low a price to the poor in London, are not sufficient in number for the inhabitants of a village, and consequently a higher price is paid for them by some, and the better and dearer joints must be purchased by others. So also with regard to bacon—the cheaper kinds are not generally offered for sale, and the poor must pay 8d. and 10d. per lb. for all that they would obtain. Salt butter is rarely to be found in hamlets, but the poor must pay 1s. 5d. and 1s. 6d. a lb. for fresh butter at the end of summer and during the winter. The greater number of persons who can buy the best joints in London enables the dealer to sell the inferior joints cheaply, and with regard to almost every kind of food so much variety in part and quality is offered, that the poor can select the cheapest. It is singular perhaps, that whilst flour is always dearer in hamlets, bread is now nearly as cheap, and in some places cheaper, than in large towns. It is, however, only of very late years that this great advantage has been conjoined with good quality, and it is perhaps the most striking feature of our times, in reference to dietary, that even in remote hamlets cheap and good bread is universally attainable.

Another question in connexion with price is that of credit. Those who are in debt with a dealer must continue to deal with him until the debt is paid, and the latter is compelled in his own interest to charge a higher price for his goods; hence even the bread is charged ½d. a loaf higher, and every kind of food feels the influence of this evil. Many may not be aware to what extent this practice exists, and how effectually it prevents the poor from proceeding to the best market. It is a practice so general among the really poor as to be almost universal, and of necessity it is the most general when the income is uncertain, and the payment of wages made fortnightly and monthly. How great a help would it be to a thrifty family if some less necessitous neighbour would advance them a week's wages, and thus enable them to buy where the goods are the best and cheapest.

As to the exceptions which I have mentioned, it must be borne in mind that vegetables, when bought in villages, are not cheap, and that milk in the neighbourhood of large towns is as dear as in the towns themselves, except that inferior kinds, as skimmed milk and butter milk, may be had in the former place only, and hence in these foods the poor in the villages may have no advantage. But, without entering more at length into this, the most self-evident part of our subject, I wish to impress upon your minds the fact that, upon the whole, the poor of our villages pay more and obtain worse food than in this great metropolis.

The amount of nutriment which can be obtained from any given food depends upon the nutritive elements of which it is composed and on the use which the body can make of them. Thus, the bark of trees and sawdust in chemical composition contain much of the elements of nutrition, but as the stomach cannot digest much of them, they would not be an advantageous food at any price. It is at this point that deductions from chemical knowledge alone have led, and I must add, are still leading, to error. Nearly all the generalisations of Liebig on the nutritive value of food were based simply upon their chemical constituents, assuming in a general manner that they would all be equally well digested and appropriated by the system. That this too hasty generalisation should have been made many years ago, cannot be wondered at, seeing that both chemical and physiological knowledge was then most imperfect, and that the authorities were chemists only; but that men of repute should, even to the present week, publish knowledge of this kind, and even take credit for it, is much to be regretted. So strong a hold do the impressions of our earlier years take upon our minds, whether they have been derived from our own observation or from the books by which we were educated. It is still not at all generally apprehended, even by good chemists, that on questions of food we must ascertain in what degree the system can appropriate foods before we can venture to affirm their relative nutritive qualities from their relative chemical composition. As I attach great significance to this fact, and shall have to apply it as we proceed, I am particularly desirous that it should not be forgotten. The question is not what nutritive elements food possesses, but how much nutritive matter the body can obtain from it. Hence, a food is economical as the body can obtain from it the largest amount of nutriment at the least cost. In proceeding to apply these general principles to the individual articles of food, I must select those elements essential to nutrition, and also name some price which shall be regarded as a standard of cost.

Nutritive Elements Selected.

As to the elements of food, I propose to select the carbon and nitrogen only, since they alone can be collected as they leave the body. If I were treating of the nutritive value of food in a chemical aspect only, apart from any daily measure of the amount required by the body, I should add the free hydrogen also, since with its combination to form water within the body it must generate heat; but we have no means of ascertaining how much heat is produced and required by the body; neither can we ascertain how much of the water which leaves the body is generated in this manner, and how much is due to that which was taken as food. Hence, in seeking to ascertain how much nutriment is required by the body, we must altogether omit any reference to this element, and must restrict ourselves to the carbon and nitrogen, for as the latter in leaving the body can be measured, they give the best indication as to how much is required to supply their place. This is the only practicable basis for dietary in a physiological point of view, and hence my object is to show in what way the largest amount of carbon and nitrogen can be obtained at the least cost.

I wish I could select terms which would be less technical, and yet be at the same time exact, but I cannot. An attempt to do this has been long made, and this also on purely chemical grounds, by calling some elements heat-givers, and others flesh-formers, as though the two had quite distinct actions; but it should be understood that in all the important foods, excepting fat, and sugar, both these classes are always found in the same food, so that bread and meat are heat-givers and flesh-formers; and it has been also proved, by the experiments of Messrs. Lawes and Gilbert, myself, and others, that nitrogen—the flesh-former—passes through the body every moment without forming flesh, and therefore cannot always be a flesh-former, and that, whilst in the body, it stimulates vital action, and promotes the change of the heat-givers, and is therefore indirectly a heat-generator. Hence physiology has again shown that the clear lines of distinction drawn by chemists and chemistry are incorrect, and lead to error. It is probable that in every case the one kind of food assists the digestion of the other, and it is certain that no such division as heat-giver and flesh-former can now be tolerated, except in a general and popular sense. It is also necessary to add that I cannot treat of them collectively, or say that a food offers so much nutriment, for these two elements are required by the body in different proportions, and foods differ in the relative quantity of each which they contain.

Hence I must speak of the two elements simply as carbon (the so-called heat-giver), and nitrogen (the so-called flesh-former), and it will not be difficult to follow all that is to be said respecting them without any chemical knowledge whatever.

Separate Foods.

Bread.—I purpose to consider bread as the first and basal element of dietary, both from its extreme importance in relation to the whole dietary, and from its universal use in this country. This may be made of white wheaten flour, brown wheaten flour, rye or barley, or an admixture of these substances. 1 lb. of white wheaten bread, made of household or seconds flour, is worth from 1¼d. to 1½d. in different parts of the country, and the most frequently 1⅜d. or 5½d. per 4 lb. loaf. 1 lb. of bread contains 1,994 grains of carbon, and 89 grains of nitrogen, or, in round numbers 2,000 grains and 90 grains, and as the cost is 1¼d., 1⅜d., and 1½d., the quantity for each 1d. will be as follows:—

	Carbon Grains.		Nitrogen Grains.
At 1¼d. ...	1,600	... ...	71
,, 1⅜d. ...	1,450	... ...	66
,, 1½d. ...	1,303	... ...	60

I will take the middle quantities as my standard, since it will apply more largely to the country than any other, and will consider that 1,450 grains of carbon and 66 grains of nitrogen are obtained generally for 1d. spent in white bread.

The above has reference to the quality known as households. When a whiter flour is used, if there be no adulteration, the cost is increased, not only because the manufacture of the flour is more costly, but because fine white English or Gennessee wheat is used, which is dearer than red wheat; but there is no evidence to show that the nutritive value is increased, except in the case of wheat selected which is grown in hot climates, and which contains somewhat more nitrogen. Taking the increased price of 2d. to 4d. a peck of flour into account, this flour is the dearer food. But it is largely the practice, and particularly in the French flour, to add rice to the very white flour in order to improve the colour, and in so doing a reprehensible adulteration of the flour occurs; for, taking the price of fine flour and rice at 2d. per lb. each, the amount of carbon and nitrogen for 1d. would be:—

	Grains.		Grains.
Flour, Carbon... ...	1330	Nitrogen... ...	60
Rice, ,, ...	1380	,, ...	35

so that with a trifling increase in carbon the amount of nitrogen has been reduced nearly half. But in truth the loss is greater, for the value of the rice does not exceed 1d. to 1¼d. per lb., and the difference between that and the selling price of the flour is to the gain of the miller and the loss of the consumer. There cannot be a doubt that it ought to be as penal to adulterate flour with rice as to mix chicory with coffee, and the law ought to require from the seller the same affirmation of the admixture in both cases.

Now to turn to the other aspect of the question. What is the effect of retaining in or of adding to the flour the bran as a whole or in part. In this matter there is a fallacy which was originated by chemists; and now that bread companies are doing a large trade, and have medical men upon their direction, who quote and scatter medical opinions, the fallacy is revived, but there is no fallacy on the part of the masses of the people. The use of white wheaten flour is extending as rapidly as possible in the western world of America (the home of the Maize), and even in the poorer districts of the world the dark-coloured bread is not the brown bread of this country, but barley or rye bread in whole or in part. The millions of this country cast aside the bran, and in doing so follow the dictates of experience, of far greater value than theoretical reasons derived from a single scientific fact, and such assertions as that of Dr. F. W. Headland, in his Medical Handbook: "This is one of the matters in which the world has gone grievously wrong;" and also that of Dr. Mapother, who, in an interesting paper lately read in Dublin, remarked: "We are receding in the art of dietetics in regard to whole-meal bread, for up to some forty years ago it was most generally used in these countries." In these assertions the terms have been inverted, and instead of testing the truth of scientific statements by universal practice they presume to set universal practice at nought, when compared with inductions which themselves can only properly flow from practical experience.

The question then is—Is brown bread cheaper than white bread in the nutrition of the body? By brown bread is universally understood the admixture of the bran, in its entire composition, with the farina of the flour, and not the exclusion of the outer husk of the bran and the retention of the inner layer. This must be understood, or the statements of persons cannot be compared, neither shall we treat of bread in actual use.

Dr. Dundas Thompson was one of the earliest authorities on this subject, and in lectures now publishing he writes as follows:—

"It is important that we should be able to analyse bran in order to be capable of appreciating the ground upon which it has been long known that this substance is alimentary, and that to remove it from flour is to deprive flour of a large amount not only of nutriment, but of meat-producing principles. It is well known, both by physiological and chemical research, that oatmeal contains more nutritive matter than any other of the cerealia. This may no doubt be in some measure due to the imperfect manner in which the bran is separated from the flour. We may truly consider these infallible physiological results which are obtained in the history of such people as enjoy robust health and longevity with oatmeal as their staple article of food; and when chemical analysis confirms these experiments, our conclusions seem to be deduced from a powerful species of induction."

Again, he writes, "I am not aware that the nutritive superiority of brown to white bread was known upon scientific data prior to the year 1843, when the writer showed that the per-centage of nitrogen in white bread (freed from water) was 2·27 = 14·8 nitrogenous principle, while that of brown bread containing bran was 2·63 = 16·43 nitrogenous principle."

Thus because bran contains more gluten and less starch than the inner portion of the wheat, it was assumed that it was more nutritious. This statement has been handed down and copied from book to book up to this day, so that in the book of Dr. Headland just quoted we find:—

"This husk contains more gluten, more nutritious matter, than the whole interior, the proportion being in the husk about 17, in the seed about 12 in 100 parts. White bread is not only more expensive, but is far less nutritious than flour in which the bran is ground. Yet the poor as well as the rich prefer white bread. The former even consider the recommendation to eat brown bread as a sort of insult. This is one of the matters in which the world has gone grievously wrong." Dr. Guy, who quotes this passage, remarks in the text of his paper on dietaries, read before the Statistical Society, "that we can make a considerable addition to the gluten and the oil by adding the bran to the flour; or making the bread of whole meal obtained from the grain either before or after the modern process of decortication." He also adds a table, to show that bran contains 8 per cent. more gluten (which is about 1¼ per cent. of nitrogen), and 9 per cent. less starch, &c.

Dr. Johnston, in his "Chemistry of Common Life," also writes, "Bread made from the whole meal is therefore more nutritive;" but he adds another chemical statement to that already mentioned, viz., that "the bran of wheat possesses also the property of dissolving the flour or bread with which it is mixed, and of rendering it more easily digestible in the stomach." He seems to regard this as an advantage, and a more recent authority makes the following remarks:—

"The conversion of the starch into dextrin and sugar likewise renders the bread darker in colour. In fact, the brown colour of wheaten bread made from flour containing fine bran, is due, not to admixture of particles of bran, but in great part at least to a conversion of the starch into dextrin and sugar by the action of the altered albuminous matter in the bran. According to Mège-Mouriès, bran contains a peculiar nitrogenous body called *cerealin*, which is specially active in inducing this conversion: it appears, however, to be identical or nearly identical, with ordinary diastase. Be this as it may, it is certain that the finest wheat flour obtained from the central portion of the grain, which contains but little nitrogenous matter, has very little tendency to undergo the change under consideration; but coarse flour obtained from the exterior of the grain is rich in azotised substances, and more ready to undergo the glucosic deterioration. In white bread of good quality, the starch has undergone very little alteration. A small portion of it is rendered soluble in water, but the greater number of the granules are simply swollen, not burst, and may be washed out of the bread, collected, and weighed."
— *Watts' Dictionary of Chemistry.*

Hence, the arguments on this side of the question are, that as the bran contains more nitrogen than the farina, and as there is a principle in bran which, acting as a ferment, aids in the conversion of starch into dextrin and sugar, brown bread is more nutritious than white bread.

Now, what does the fact amount to? An average sample of wheat will yield one fourth to one-fifth of its weight of bran, and so far whole meal, or brown flour, will contain more nitrogen and less carbon than white flour. The estimate of the contained nitrogen in bread, as made by Dr. Thompson twenty years ago, on Prussian bread, is higher than is applicable to the bread of this day, for instead of being 2·27 per cent. dry, or 1·59 per cent. fresh, it is now only 1·3 per cent. fresh. But if we accept the relative statement as to the respective quantities of nitrogen in the white and brown bread, we shall find that the increase in 1 lb. of brown bread is about 20 grs., whilst the carbon is reduced. As to the latter assertion viz., that the cerealin of the bran aids the conversion of the carbonaceous elements, as the action is deteriorating, it can be useful only as it is necessary. But both statements alike ignore the action of the living body, and assume that the nitrogenous fluids of the body are insufficient to provide the starchy and saccharine transformation, and also that the nitrogen in the bran will be appropriated as freely as that of the farina, and thus, upon an assumption of these, which are the essential facts, the inference that brown bread will be more nutritious, is drawn. That is "begging the question." Moreover, it is well known that the body itself furnishes a substance which, acting like a ferment, procures the conversion of the starch into sugar, and there is no evidence to show that the converting property of the cerealin is as necessary to digestion as it is deteriorating in the destruction of nutritive matter.

Let us now see what can be said on the other side. Dr. Prout is quoted by Dr. Guy in support of this brown-bread nutriment theory, but with singular infelicity, for Dr. Prout, instead of regarding bran as nutritious, terms it excrementitious. Thus he is quoted by Dr. Guy:— "Bread, therefore, made with undressed flour, or even with an extra quanty of bran, is the best form in which farinaceous and excremental matter can be usually taken, not only in diabetes, but in most of the other varieties of dyspepsia, accompanied by obstinate constipation. This is a remedy, the efficacy of which has been long known and admitted." Hence, he regards bran as a remedy for constipation, which nature has conjoined with food, and therefore denies that it is food, or directly adds to the nutriment of the bread; and in this view of the action of bran he is joined by the medical profession generally— by the poor, who have used it and ceased to use it—and by the rich, who need a remedy for constipation. This question is now of the greatest interest (otherwise than as a commercial one) in reference to prison dietaries, and, when under examination before the Committee of the House of Lords, this year, in answer to the question (No. 988), "Will you state what sort of bread you would recommend?" I replied, "I think it essential, for prison diet, that it should be white bread, or if not white bread it should have the bran ground finely. My reason for this is, that I and others have shown that the bran of brown bread—as the husk of oatmeal and the shells of peas— hastens the nutritious material through the bowels. We therefore have a larger waste of food if we give the bran with the bread, and the husk with the oatmeal, and the shells with the peas, than we should without them." When these words were read to Dr. Guy, the other scientific witness, at his examination before the same Committee, and question put by the Chairman (No. 3,796), "Would your experience enable you to confirm that statement?" the reply is, "Yes; I should agree with that statement. If whole-meal bread were found to produce diarrhœa, I should expect it to prove less nutritious." In answer to a former question (No. 3,789), "Is there any objection to using all that there is in wheat?" the same authority replied, "I think not;

but that must be a matter of experiment. If it were found that by continuing brown bread for a long time, diarrhœa was occasioned, it might become necessary to substitute white bread on certain days of the week, but brown bread should be used as much as possible."

Thus the excremental quality of the bran is, I may say universally, admitted, and if in its full action it will purge, in its less and more constant action it will tend in the same direction, and cause more frequent and free removal of material from the body than occurs with white bread. But this latter action, which had not been estimated, has been established by the experiments of Mr. Milner and myself, as a Committee of the British Association appointed to make inquiries into the influence of prison punishment and dietary over the bodily functions of prisoners, which are very extended, and as they are the only similar ones on record, I must refer to them to prove that under the influence of the brown bread dietary, the waste by the prisoners was more than twice as much as that occurring in ordinary life. Hence here is a food inducing an action which, in its full effect, is one of disease, and is to be restrained, and, in its less effect, causes the removal of double the amount of nutritive elements from the body which occurs without it, which is recommended by medical men, and taken by the richer classes as a remedial agent to remove constipation, and hence, of necessity, must increase the waste of food, but still it is affirmed to be more nutritive, because it is ascertained out of the body to contain a larger quantity of a chemical element, which, if used by the body, would afford nutriment. Such are the hasty deductions upon which this theory has been based; and Dr. Guy, in his evidence just quoted, and in answer to the question No. 3788, "Why would you prefer brown bread?" replied, "the only bread used in prisons should, I think, be brown bread, partly because it is more nutritious and contains more of the muscle-making element in it (the nitrogen which has been spoken of) than white bread does." But how much further, let us ask, can this *non sequitur* be carried when it is known that the bran itself passes out of the body unchanged, as may be ascertained by any observer, and as was proved by us in our analyses daily for two months in prisons—this wonderfully nutritive material, which contains so much of the muscle-making element, and which must, besides, have the faculty of being in two places at the same time!

The proper place in which the action of bran should be arranged is manifestly that of a medicine (and it would be easy to show that it is a bad one), as stated by Dr. Prout, and as practised by mankind, and therefore to be used when constipation occurs, or when, as is commonly the case, this is accompanied with the excess of food to which the well-fed and under-worked classes are accustomed. Hence, when I was asked by the Committee before-mentioned, No. 987, "Then the general prejudice which prevails amongst the agricultural community that the finest white bread is the best for them, and the most nutritious, is correct," I replied, in language not my own, "Certainly, it is correct. Brown bread is the rich man's and not the poor man's diet." I thought this necessarily followed from the statement of the action of the brown bread, which had been given in answer to No. 988, and assented to by Dr. Guy, in answer to No. 3,796 already quoted; but when my answer was read to Dr. Guy, No. 3,797, he replied, "I do not agree with that view of it; I think brown bread is especially the poor man's dietary, not the rich man's. I should reverse that answer." So that the poor man, who can scarcely obtain food enough to keep body and soul together, must for his own good take that kind of bread which is less agreeable, and will cause more waste of his food in order to be consistent with a single fact in science. It is clear that science and bran together would be the death of him, only that his own experience had taught him to cast both aside, to leave the physic to them who can afford to take it.

It is, perhaps, unnecessary to proceed further in the matter, or I might adduce the experience of persons in feeding horses and pigs with the bran and the inner husk of wheat, or sharps. When a bran mash is given to a horse it is given as a medicine, and no one who has had the least experience in feeding pigs would give sharps—the highly nutritious inner husk of wheat!—instead of barley meal, which contains so much less nitrogen. Moreover, the price of the bran and sharps indicates the estimate which is formed of their nutritive values. Thus:—

1 bushel of	seconds flour,	weighing	56 lbs.	costs	7s. 9d.
,,	bran	,,	12	,,	9d.
,,	coarse pollard	,,	14	,,	10d.
,,	fine pollard	,,	18	,,	1s. 0d.
,,	sharps	,,	26	,,	2s. 0d.

I have entered at length into this question on the ground of its importance, both in a scientific and social point of view, and I trust that we shall assent to this conclusion, that, at equal cost, brown bread is dearer than white bread, and from its medicinal action should be used intermittingly and not continuously (if used at all), and should not be used by the poor man. The relative values when difference of cost occurs must depend upon the amount of difference. Years ago white flour was from 2d. to 4d. a peck dearer than brown flour, but the quantity of the latter which is now made is so much reduced, that when wheat of equal quality is used there is no difference in price in some localities, as in London, and but little difference in country places. Hence there is now nothing in favour of its use by the working classes, but if a large sale of it at the present high prices could be effected, the bakers, buying it in large quantities at a cheaper rate, would make larger profits by it.

Barley bread is much inferior to wheaten bread in the amount of nitrogen which it contains, but it is so much cheaper that, where the flavour and dark colour are not objected to, its use is economical. The meal is sold at 1s. and 1s. 2d. the 14 lbs., and if we take the higher sum, we shall find that 2,500 grains of carbon and 93 grains of nitrogen will be obtained for 1d.

Rye alone is not made into bread at the present day, but it is mixed with wheaten flour to make brown bread. It contains more nitrogen than barley and less than wheat, but both are remarkable for the large amount of indigestible husk which is found in the bread.

As the bread in use in this country is derived from the grains already referred to, it will be convenient to consider here the economy of baking the bread at home. The discussions which have recently taken place in the *Times* have shown that not less than 94 loaves of 4 lbs. each, and one baker admitted that 95 loaves of 4 lbs., could be made from 280 lbs. of flour, not necessarily so that every loaf could be sold at the highest price. The quantity varies with the soundness and highly nitrogenised qualities of the flour and the skill of the baker, so that in numerous experiments made at home, I found that the quantity of bread varied from 19 lbs. to 20½ lbs. from the peck of 14 lbs. of flour. 95 loaves to the sack, and 19½ lbs. to the stone, are equal to the quantity of flour multiplied by 1·4, and whilst the quantity of bread should be somewhat greater, it ought not to be less. Where the 4 lb. loaf may be purchased for 5½d., the flour may be bought retail at from 1s. 10d. to 2s. the peck. If we select the former price we shall obtain 16 lbs. of bread for the same price as 14 lbs. of flour, so that the value of 3½ lbs. of bread (the extra quantity which should be produced from the peck of flour), represents the cost of baking and gain if any. The cost will include yeast, which will vary from 1d. to 1½d., salt, and the cost of the firing, which would not be so much as the balance, 3d. or 3½d. The labour of the housewife need not be taken into the account, and where there is convenience for baking, it is probable that 2d. to 3d. per peck will be saved where fuel is cheap. In London the cost of bakers' bread and flour is nearly the same.

Oatmeal and Indian corn are not baked into loaves, and wherever they are eaten it is most usual to eat them in a moist state. Oatmeal is richer in nitrogen than wheaten flour, but this is owing very much to the husk, which is not thoroughly removed, and which when taken into the body is not digested. The price of oatmeal is now universally 2d. to 4d. per peck of 14 lbs. higher than that of household flour, so that the gain in the use of oatmeal is lessened. The amount of carbon and nitrogen to be obtained for 1d. when oatmeal costs 2s. 2d. the 14 lbs., is 1513 grains of the former and 75 grains of the latter.

Indian corn, or maize, may be purchased here at the price of barley, and as it contains much more nitrogen and carbon than the latter, it is by far the cheapest food hitherto mentioned. Thus at 1s. 2d. per stone of 14 lbs. there will be no less than 2,800 grains of carbon and 121 grains of nitrogen obtained for 1d.

Rice and Peas.—Rice has already been mentioned, and it remains to speak of peas and beans in connection with this part of the subject, since, whilst peas are usually eaten after boiling, there are parts of the country where they are added to other foods in making bread. Split peas may be purchased at 1½d. per lb. retail, and at that price will yield 1820 grains of carbon and 170 grains of nitrogen for 1d. Hence in the latter particular, they far exceed in economy all the foods already mentioned. It must however be stated that this analysis refers to whole peas, and assumes that the whole will be ground into meal, but when they are boiled the shells are indigestible, as has been already pointed out, and lead to waste of food. Hence, although split peas are somewhat dearer, it is probable they are more economical.

The foods which are thus associated offer a wide range in their relative economy, so that some have twice as much carbon and others twice as much nitrogen as the standard quantity found in bread, and in relation to the same monetary value and in their effect upon the system would probably differ but little from that proportion. Hence it may be asked, " Why is it that the cheaper foods are not universally selected." The answer must have reference to the income and the tastes of the people. So long as good wheaten bread can be obtained its approved flavour will commend it, whilst other and cheaper foods will only be used as adjuncts. It is only as the real wants of the system are greater than the income spent on bread will supply, that unusual and less agreeable foods, as peas and beans, barley, rye and maize, will be accepted. In all these discussions a practical as well as scientific view must be taken, and to the destitute class only can we commend the use of such foods with success (and only then as a temporary expedient), whilst any general attempt to enlist the sympathies of those who can purchase white bread will certainly fail.

Fresh Vegetables.—Potatoes will be dear or cheap as they are purchased or grown, and therefore their value will be differently estimated by persons occupying the two positions. Moreover, when they are purchased their cost varies much at different seasons and in different parts of the country, so that it will not be easy to obtain an approved standard for our calculations. I purpose to select ½d. per lb. as a medium cost, and at that price 1540 grains of carbon and 49 grains of nitrogen, would be obtained for 1d., but as the price is often 1d. per lb. in London and other large towns, only one half of that quantity would be then purchased for 1d.; hence their inferiority to the standard quantity in reference to nitrogen is very striking, and at either price they are dear food.

Other fresh vegetables may be classed together, and if we consider that 2 lbs. in weight could be purchased in London and large towns for 1d., and 4 lbs. in country villages for the same sum, we shall find that the carbon and nitrogen obtained would be respectively 820 grains, and 1640 grains of the former and 28 grains or 56 grains of the latter, and hence would closely correspond with the nutritive value of potatoes when purchased at ½d. per lb.

When potatoes and green vegetables are grown by the consumer, their cost is represented only by the rent of the land and the manure, and often by the former only, for manure is often collected, and the planting and gathering of the crops effected by the labour of the family, and as that labour could not be otherwise profitably employed, the potatoes add to the wages of the family, or are obtained almost without cost, as the question may be regarded. Such persons have great advantages over those who must buy their food, and exhibit a real economy in extending the use of fresh vegetables as far as their appetite and health or their means of production will allow.

Fats are allied to the class of foods now discussed, in that both constitute the chief supply of carbon to the system, but they differ in offering no nitrogen. They also contain much free hydrogen, which is useful to the system, but for the reason already given I shall refer only to the carbon. Those fats which are in common use, when separated from other foods, are butter, lard, dripping, and suet. The prices differ greatly, and particularly that of butter, so that I must take a medium, and shall select 1s. 2d. per lb. for butter, 9d. per lb. for lard, 6d. per lb. for dripping, and 7d. per lb. for suet. At these prices the following are the quantities of carbon which can be obtained for 1d.: — Butter, 327 grains; lard, 591 grains; dripping, 886 grains; and suet, 657 grains. Hence butter is by far the dearest of the fats, and dripping the cheapest, whilst the average of the whole is not nearly half of the standard quantity of carbon, omitting any reference to nitrogen.

Sugars, like fats, yield no nitrogen, but supply carbon largely. The two kinds are sugar and treacle, each having much variation in price, but little in nutritive value. I propose to consider sugar to be worth 4½d. per lb., and treacle 3d. per lb., and at these prices the quantity of carbon afforded by them at the cost of 1d. is, sugar, 622 grains, and treacle, 746 grains. Treacle is thus the cheaper, but its use is more limited than sugar, and could not supplant the latter. The relation of the nutritive value to the standard in bread is almost the same as that of fats, and both are dear foods as compared with the standard. It is also seriously doubted whether the elements of which sugar is composed can be rendered equal in nutritive value to the same elements in fat; and, although this cannot be determined at present, it seems probable that the absence of sugar in a dietary would be less important than the loss of an equivalent value in fat.

Meats.—The determination of the exact economic value of meats is a work of great complexity, owing to the different kinds and joints of meat which are used, containing very different relative quantities of fat and lean, and the valuable flavoured juices of the meat. All contain both carbon and nitrogen, and these will vary as the fat and lean vary. As a general expression, it may be stated that in point of cost, beef and English bacon are the dearest, whilst American bacon, mutton, and pork are the cheapest. In reference to the nutritive elements, bacon, pork, mutton, and beef have the greatest quantity of fat, beginning from the first, and will therefore be richer in carbon than beef, whilst the latter will exceed the others in nitrogen. If we consider that the average price of beef is 7½d., of mutton and pork 7d., of English bacon 8½d., and of American bacon 4½d., we shall find the following quantities of each to be procured for 1d:—

	Carbon.	Nitrogen.
Beef	320 grains	23 grains.
Mutton	415 ,,	20 ,,
Pork	483 ,,	18 ,,
Dried English bacon	510 ,,	12 ,,
Wet American bacon	918 ,,	17 ,,

Hence the quantities of carbon vary from 320 grains to 918 grains, and of nitrogen from 12 grains to 23 grains, so that when compared with the standard they are deficient by two thirds.

A communication addressed to me by the Consul of Uruguay led me to expect the receipt of specimens of dried meat from South America, which, after examination and consideration, I might have included in my list of foods, but the parcel has not yet arrived.

Time does not permit me to consider the propriety of admitting or rejecting the flesh of animals which have died from accident or disease (thence often misnamed diseased meat), and which is sold cheaply. There is a natural repugnance to the use of this food, and yet it has been eaten in various parts of the country in all ages, as for example the braxy mutton of Scotland, and veal from calves dying natural deaths in Wales, and no evil has been traced to it. So also with animals dying from accident, such as suffocation on board ships in a storm, or by acute inflammations, it has not been shewn that any change has taken place in the flesh, which, when eaten, would produce unhealthy nutrition. The case is far different when the animals have been long ill, or when the disease has been a specific one, which could in other ways have been transmitted. As there is not time to discuss this important question properly, I should regret saying anything which might lessen our repugnance to the use of the flesh of animals dying from any disease, but I am of opinion that some of the denunciations which have recently been hurled against them are not supported by known facts, and that in the interests of science as well as of justice nothing should be asserted which cannot be supported by proof. As there could not be any means of distinguishing the meat of animals dying of different diseases (except in a few cases), it is only at present practicable to wholly admit or wholly exclude it, and the latter is doubtless the safer plan.

There are two substances in reference to meat to which I must further refer, viz., liver and bones. There is a scientific prejudice against the use of liver on account of the frequency with which it is diseased, but when it is cut into thin slices and no disease is evident to the eye, it is only necessary that it be well cooked. It is an economical food, for if it cost 3d. per lb. it will yield 410 grains of carbon and 70 grains of nitrogen for 1d.

Bones are used by every housewife, if she have them, when she makes soup or broth, and yet there is a scientific prejudice against them because an inquiry made by "The Gelatin Commission" in France many years ago, proved that animals could not live on bones alone. Here again we have a hasty generalization, for whilst the conclusion just mentioned was proved, it was not shown that bones may not be advantageously used as a part of the dietary—yet from that conclusion and the further fact that the residue of digested (or boiled) bones consists largely of gelatin, arose assumption that gelatin wasnot nutriment, yet medical the men order jelly for sick diets, and everybody who can obtain a jelly, if it is nicely flavoured, enjoys it, and all have the impression that it nourishes. Moreover, in my experiments I proved that when jelly had been eaten the emission of nitrogen was increased—thus showing that the jelly had been absorbed and converted into other substances; yet, with the habit of writers to hand down that which has been written, the writers on diet of to-day deny the nutritive value of gelatin. As bones cost about 1d. per lb. and when cooked may be sold again for a ½d. per lb., the analysis which I made for the Government proved that 1d. worth of bones well digested gave 1566 grains of carbon and 48 grains of nitrogen, so that I trust science will not prevent your using them.

Fish.—Of fish I shall refer only to herrings, since it is impossible to fix a uniform price to that article of diet. If we take a dried herring of the size sold at three-farthings each, and a fresh one sold at one half-penny each, the following will be the amount of carbon and nitrogen per 1d.

	Carbon.	Nitrogen.
Dry	352 grains	54 grains.
Fresh	480 ,,	72 ,,

The size will vary with the state of the market, but fresh herrings are more economical than dried herrings at the price named, and, whilst greatly below our standard in carbon, approach it very nearly in hydrogen.

Milk.—Milk is used as new milk, skimmed milk, and butter-milk. These differ extremely in the price paid for them, but they approximate closely in the nutritive elements which they contain, for skimmed milk differs from new milk only in having lost the butter, and butter-milk from skimmed milk only in having lost a portion of its sugar and gained a portion of acid. Hence, skimmed milk and butter-milk may be rendered nearly equal to new milk by adding a proper quantity of fat to them.

I do not think that a medium price can be selected for each of these kinds of foods, since they are purchased at the different places at different and yet fixed prices, over large areas of the country, but I will name the following:—New milk, 1d. and 2d. per pint; skimmed milk, ¼d., ½d., and 1d. per pint; and butter milk, ⅙d. and ½d. per pint. At these prices the following quantities of the elements may be obtained for 1d.

			Carbon.	Nitrogen.
New milk	1d.	per pint	546 grains	44 grains.
,,	2d.	,,	273 ,,	22 ,,
Skimmed milk.	¼d.	,,	1,748 ,,	174 ,,
,,	½d.	,,	874 ,,	87 ,,
,,	1d.	,,	437 ,,	44 ,,
Butter milk	⅙d.	,,	2,514 ,,	262 ,,
,,	½d.	,,	838 ,,	88 ,,

If we select skimmed milk and butter milk at their lowest price, we find that they exceed the standard in carbon, and are very much richer in nitrogen. Even buttermilk at the highest price, and skimmed milk at its medium price, are higher than the standard in nitrogen but deficient in carbon, whilst new milk at the highest price is somewhat dearer than beef, and incomparably dearer than the standard. As the cost of milk cannot be varied by the purchaser, but each person must in his own locality pay the price demanded, it is easy to perceive how much more highly-favoured some portions of the community are than others, and how unfavourably the inhabitants of this metropolis compare with those of small towns and villages. How absurd also is the frequent habit, even among the poor, of regarding butter milk as a food for pigs and not for man.

Whey.—Whey is nowhere sold by farmers I believe, and in but few places is it regarded as a food worthy of man. It is not a rich food, for nearly all the cheese and butter have been extracted in its production, but yet each pint contains nearly 200 grains of carbon and 15 grains of nitrogen, so that it is much more economical to drink whey than water.

Cheese.—Cheese is a substance particularly rich in nitrogen, and the poorest kinds of it, namely, those made from skimmed milk, contain the greatest amount of this element. It is very probable that the only real difference between skimmed milk cheese and new milk cheese, is in the absence of butter in the former, and its presence in greater or less quantity in the latter. Hence the latter will be richer in carbon, besides being more agreeable to the palate. There is a great difference in the value of these kinds of cheese, so that whilst skimmed milk cheese is obtained at 3d. per lb., it is needful to give 8d. for a fair sample of new milk cheese; and accepting those prices we shall find the amount of carbon and nitrogen which can be obtained for 1d. as follows:—

	Carbon.	Nitrogen.
Skimmed milk cheese	732	122
New milk cheese	333	40

The difference in the economic value of the two kinds is exceedingly great, but it is not known whether both are equally digestible and appropriated by the system. It is highly probable that when more than half an ounce of cheese is eaten at a meal a considerable portion passes off unused, for in my experiments the amount of nitrogen which enters the blood when two ounces of cheese had been eaten was far less than was contained in the cheese. Admitting, then, that there is a waste of material whenever cheese of any kind is eaten in large quantities, I doubt if there is any ground for the belief that the cheaper kinds of cheese are less digested than the other, provided the following conditions be fulfilled in both cases, viz., that the cheese be neither new nor old, but the skimmed milk cheese about 6 months, and the new milk cheese from 6 to 12 months old. If too new, the skimmed milk cheese is tough, and if too old, it is hard and therefore in both cases it will be imperfectly masticated.

When compared with our standard, skimmed milk cheese far exceeds it in nitrogen, whilst both kinds are greatly deficient in carbon, and from this must also be taken an unknown quantity for the supposed loss in digestion. It is a great mistake in the poor to buy high-priced cheese, and cheese at whatever price which is strong to the taste.

Tea.—Tea was largely considered by me in the paper[*] which I had the pleasure of reading before this Society two years ago, and which the council honoured with a medal. It is by far the least economical of all the substances used as food, since if valued at 3d. per oz. it would not give more than 4 grains of nitrogen and an infinitesimal quantity of carbon for 1d. Hence, as affording nutriment, its purchase is most wasteful; and although it is useful by enabling the poor to drink hot water in an agreeable form, it is most desirable that its cost should be reduced to the least possible amount.

Alcohols.—I do not propose to discuss the value of alcohols in this paper, since regarded as food they offer extremely little nutriment in proportion to their cost, and regarded as medicinal agents their worth cannot be measured by the nutritive material which they contain.

Summary.

I have now completed the details which I proposed to lay before you, and, in conclusion, have only to sum up the subject by showing at what cost the standard quantity of carbon and nitrogen may be obtained from the various foods which have now been considered. The standard quantity required is 1450 grains of carbon and 66 grains of nitrogen, at a cost of 1d.

As to the Carbon.

Maize will yield the standard quantity at a cost of ½d. Buttermilk (bought at 6 pints for a penny) and barley meal at a little more than ½d.; peas, green vegetables (costing ¼d. per lb.), potatoes (costing ½d. per lb.) and oatmeal and bones, at from ½d. to 1d. Fine flour, rice, buttermilk (costing ½d. per pint) at from 1d. to 1½d.; green bacon, skimmed milk (costing ½d. per pint); dripping, green vegetables (costing ½d. per lb.); treacle and skimmed milk cheese, at from 1½d. to 2d.; suet, sugar and lard, at from 2d. to 2½d.; new milk (costing 1d. per pint); fresh herrings and pork, at from 2½d. to 3d.; mutton and skimmed milk (costing 1d. per pint), at from 3d. to 3½d.; dried herrings, butter, new milk, cheese and beef, at from 4d. to 4½d.

As to the Nitrogen.

As the relative quantity of nitrogen to carbon is not high in bread, we shall find that numerous articles of food offer the nitrogen at less cost than bread, whilst at the same time the extreme variation from bread is in reference to the nitrogen. Thus, butter milk (costing ⅙d. per pint), will give the standard quantity of nitrogen for ¼d.; skimmed milk (costing ¼d. per pint), peas, and South American beef, at from ¼d. to ½d.; skimmed milk, cheese, and maize, at about ½d.; butter milk and skimmed milk, each costing ½d. per pint, and barley meal, at ¾d.; oatmeal, fresh herrings, and liver, at from ¾d. to 1d.; fine flour, green vegetables (costing ¼d. per lb); dried herrings, new milk, and skimmed milk (each costing 1d. per pint), and bones at from 1d. to 1½d.; new milk cheese, at a little more than 1½d.; green vegetables (costing ½d. per lb.); potatoes costing 1d. per lb.; beef and new milk costing 2d. per pint, at from 2d. to 3d.; mutton, pork, and green bacon, at from 3d. to 4d., dried bacon, 5½d., and tea, at 20d.

These with other facts are contained in the following table:—

TABLE, showing the quantity of Carbon and Nitrogen contained in 1d. worth of various foods at the prices annexed, and also the variation from the pennyworth of various foods to supply as much Carbon and Nitrogen as are contained in one pennyworth of bread (the standard quantity).

Food.	Costing.	Carbon for 1d.	Nitrogen for 1d.	Variation from cost of 1d. to supply the standard quantity of 1450 grains of carbon and 66 grains of nitrogen	
				Carbon.	Nitrogen.
	d.	grains.	grains.	d.	d.
Bread	1⅝ per lb.	1,450	66	..	...
Fine flour	2 „	1,330	60	1·09	1·1
Barley	1 „	2,500	93	·58	·7
Rice	2 „	1,380	35	1·05	1·88
Oatmeal	1¼ „	1,513	75	·957	·88
Maize	1 „	2,800	121	·51	·545
Peas	1½ „	1,820	170	·796	·388
Potatoes	½ „	1,540	49	·94	1·34
Potatoes	1 „	770	24½	1·88	2·69
Green vegetables ...	¼ „	1,640	56	·88	1·18
Green vegetables ...	½ „	820	28	1·76	2·36
Butter	14 „	327	...	4·43	...
Lard	9 „	591	...	2·45	...
Dripping	6 „	886	...	1·63	...
Suet	7 „	651	...	2·22	...
Sugar	4½ „	622	...	2·34	..
Treacle	3 „	746	...	1·94	..
Beef	7½ „	320	23	4·53	2·87
Mutton	7 „	415	20	3·49	3·3
Pork	7 „	483	18	3·0	3·66
Liver...	3 „	410	70	3·53	·94
Bones	½ „	1,566	48	·92	1·46
Dried English bacon	8½ „	510	12	2·84	5·5
Green American bacon	4½ „	918	17	1·58	3·88
Dried herrings ...	¾ each.	352	54	4·1	1·22
Fresh herrings ...	½ „	480	72	3·0	·91
New milk	1 per pint.	546	44	2·66	1·5
New milk	2 „	273	22	5·32	3·0
Skimmed milk ...	¼ „	1,748	174	·82	·38
Skimmed milk ...	½ „	873	87	1·64	·76
Skimmed milk ...	1 „	437	44	3·28	1·52
Butter milk ...	⅙ „	2,514	262	·576	·25
Butter milk ...	½ „	838	88	1·15	·75
Whey	...	...	...	...	...
Skimmed milk cheese	3 „	782	122	1·98	·54
New milk cheese ...	8 „	333	40	4·33	1·65
Tea	3 per oz.	...	3·3	...	20·0

I have only now to offer an apology for the length of this communication, and to state that with the information obtained I shall be prepared to consider the combinations of foods in private and public dietaries, should an opportunity be offered to me.

DISCUSSION.

Dr. Lankester (responding to the invitation of the chairman) said they must all feel the importance of this subject, and they were much indebted to Dr. Edward Smith for bringing it before the Society. At the same time he felt that the great food question could not be decided merely by a few experiments. This was a subject to be treated with the greatest caution, and all that had been done hitherto, only served to indicate the direction in which further inquiry must go. Our Government had been lately paying attention to this question, especially by means of that Committee before which Dr. Edward Smith himself had given evidence, but he (Dr. Lankester) must say that, in certain practical departments, the Government had paid little or no attention to this matter. He formerly held the office of Superintendent of the Food Museum at South Kensington, but he felt bound to say no encouragement was given him or the other officers of that department in the proper development of it. Enormous sums had been expended in the purchase of works of art which, in his opinion, were of little value as compared with the more important matter of the food of the people: and every effort appeared to be made to suppress the development of that department of the museum. Dr. Edward Smith had rather disparaged the experiments of

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[*] Vol. IX., p. 185.

Liebig and his school, but he (Dr. Lankester) must say they were deeply indebted to that great chemist for the light he had thrown upon the subject of chemical physiology; and though Dr. Smith was inclined to disregard the distinction drawn by Liebig between heat-givers and flesh-formers, yet he (Dr. Lankester) thought there was no better mode of describing those articles of food which supplied carbon and those which supplied nitrogen. Dr. Smith appeared to have ignored hydrogen, which was a powerful heat-giving agent as well as carbon; consequently, when the hydrogen derived from such food as fat and butter was disregarded, a false view of the value of those articles of diet was arrived at. The fact was Liebig was quite correct when he stated that the value of butter and fats in relation to sugar and starch as heat-givers was as 2½ to 1. Our knowledge of the action of various foods was one to which further contributions were constantly being made. With regard to the influence of alcohol, a subject treated by Dr. Smith before this Society two years ago, the experiments of M. Baudot had materially modified the conclusions arrived at by Messrs. Lallemand and Perrin, and this showed how carefully this subject of food should be approached. He had been at some pains to consider some of the practical questions with which Dr. Smith had more particularly dealt. With regard to the question of brown bread, he could say he had eaten it himself regularly for the last 20 years, with considerable advantage; at the same time, he was free to confess that upon its introduction into families there was a distaste manifested towards it by children, which he was at a loss to account for. With reference to the point urged by Dr. Smith, that brown bread was of an excrementitious character, he thought the experiments on which that conclusion had been arrived at were limited and vague. He (Dr. Lankester) thought that Dr. Smith had been led into error from having found in his microscopic examinations of excrement the cellulose of the bran, which was not capable of assimilation, or at least only so to a partial extent. The substances which were passed off when brown bread was eaten, were those which were not digestible, and which he (Dr. Lankester) had characterised, in his analyses at the South Kensington Museum, as substances accessory to food, and not really food, but which he allowed had been estimated by the school of Liebig as heat-givers, but which should properly be regarded as accessory or excrementitious matters. It seemed to be quite neccessary along with the food to take a certain quantity of indigestible matter. He therefore thought Dr. Smith had not quite proved that throwing away the bran was not injurious to the community by whom it was practised. Then there was another element in the consideration of this question, namely,—that the value of foods was not to be estimated solely by the amount of carbon and nitrogen which they contained, but their mineral elements must be taken into consideration. Many of the substances mentioned contained mineral constituents, but Dr. Smith had not alluded to these. The potatoe might be an expensive thing with regard to carbon and nitrogen, but it might turn out to be a cheap thing with regard to its mineral constituents. Words could hardly exaggerate the importance of that vegetable as a food. They found as it increased in price so disease increased. It was an article of so much importance, that the Registrar-General published the prices of it, and in proportion as these rose, marriages and births decreased and deaths increased. What did that depend upon? Not on the carbon and nitrogen, but probably on the mineral elements. Milk and cheese respectively contained these mineral constituents in a large degree. The latter was not only valuable on account of the caseine and butter it contained, but also on account of its mineral constituents, and he thought Dr. Smith should not have left them out of consideration. The relative digestibility of the various kinds of food was also most important. He had shown that split peas and maize bread were the most perfect kinds of food they could use, considered in the relation of their chemical constituents to their price. Why then should anything else be eaten? Simply because the nitrogen so essential to the body was not taken so readily from bread as from meat, so it was better to pay twice the amount for it in the form of fresh meat than in bread: it was the ready appropriation of animal food which made it so important as compared with the various forms of vegetable food. If they fed soldiers and sailors, paupers and prisoners, on such principles as Dr. Smith had advocated, they would feed them to their injury. They could, however, hardly have fed soldiers worse than they did up to the last few years. It was indeed folly to feed men with boiled beef, throwing away the water in which it was boiled and giving merely the fibrous matter of the meat, from which all the nutritious juices had been extracted. He should be glad to see the time when men like Dr. Smith, Mr. Lawes, Dr. Gilbert, and others, who had worked with so much earnestness and care on this subject, were consulted by the Government, and a proper dietary laid down for our public establishments.

Dr. Gilbert thought all recent investigation tended to show that the relative values of different food-stuffs could not be so directly estimated by their proportions of nitrogenous or so-called flesh-forming substances as had been generally supposed. It was maintained that bread containing the bran of the wheat was better food for the labouring classes than white bread, because it contained more nitrogen. He quite agreed with Dr. Smith, however, that whole-meal bread was the rich man's, not the poor man's food. It would hardly be doubted that the man who was rather under than over fed would improve his white-bread diet much more by the addition of fat bacon than by the retention of the bran in the flour. Yet, by the use of the bacon, the labouring man diminished considerably the proportion of the nitrogenous to the non-nitrogenous constituents in his food. Even the classes who used the leaner meats undoubtedly reduced the proportion of the so-called flesh-forming to the so-called heat-producing constituents, by the admixture of animal with vegetable diet, owing to the large quantity, and high equivalent of the fat which the former introduces into their diet. It was probable, however, that those who are well-fed on a mixed animal and vegetable diet, do take a larger actual quantity of nitrogen into the system than those exclusively fed on vegetable food. A certain quantity and proportion of nitrogen were of course essential, but as our current food-stuffs go, the under fed seemed generally first to feel the want of more of the non-nitrogenous matters. In settling dietaries on chemical principles, he (Dr. Gilbert) thought it important to take into the calculation what was called the free hydrogen; a point which he illustrated by reference to figures, showing that in the case of the animal aliments, it made a considerable difference whether the free hydrogen were estimated or not. Independently of ultimate composition, digestibility and assimilability were, of course, important points to consider; and here came in observation and experience to modify the conclusions deduced from purely chemical data. It had been remarked that hence error arose, in not eliminating the cellulose in estimating the nutritive values of foods. Undoubtedly a large quantity of cellulose passed from the body undigested; but recent investigations of Mr. Lawes, himself, and others, had shown that ruminant animals digested a good deal of the cellulose they took into their stomachs. There were not, as far as he was aware, any facts showing whether or not the human economy appropriated any considerable quantity of cellulose. It might, however, safely be concluded that the indurated cellulose of bran would be little, if at all, amenable to the digestive process, and there was no doubt that the branny particles did keep up an active condition of the bowels, and tended to aid the passage from the system of undigested or unassimilated, but digestible or assimilable material.

Dr. **Wyld** remarked that Dr. Lankester had made an eloquent appeal on behalf of bran, but at the same time he (Dr. Wyld) declared himself a convert to Dr. Smith's view on that subject. The various national predilections for certain descriptions of food were remarkable. On the part of the Scotch there was a national preference for oatmeal, an article of food which was adapted to the peculiarities of the climate. The almost universal dislike of children to brown bread he attributed to an instinctive desire for that food which most promoted the physical development of the body and which contained the smallest amount of *débris*. When the Government attempted to force brown bread upon criminals it occasioned insurrection amongst them, which seemed to show that they instinctively knew better than Government what was good for them. There was one view of the subject which had not been touched upon. Chemists had written learned works upon the necessity of taking food containing a certain proportion of nitrogen, but at the same time they laid no stress upon the nitrogen contained in the atmosphere; they laid stress upon the oxygen and ignored the nitrogen. Science had not been able to prove that the animal system absorbed nitrogen from the atmosphere, but he had no doubt this would be manifested by the further progress of science. It was a common observation amongst dentists and medical men that the teeth of the rising generation were bad, and decayed very rapidly, and in this respect he might perhaps say a word in favour of bran. The Scotch who fed on oatmeal had, as a rule, larger, stronger, and better teeth than were found amongst the pork and white-bread eating peasantry of this country. It was the prevailing opinion of medical men of the present day, that children required a considerable proportion of animal food, and he thought that as a rule they had too much, and that the decay of the teeth was in a great measure attributable to that cause. He had been struck with the fact that so few varieties of bread-food were employed; the only ones were white and brown bread. He saw no reason why they should not have tempting varieties of bread made by the combination of oatmeal, ryemeal, barleymeal, potatoes, &c. By the introduction of such admixtures, they might be enabled to employ a smaller amount of animal food, especially in the case of children. Dr. Wyld proceeded to express an opinion unfavourable to pork as an article of food, and remarked that it was prohibited as unclean by Moses, whose hygienic regulations had never been surpassed. One remarkable result incidental to eating raw pork, which was often in a diseased state, was the production of the tape worm in the human stomach. He also condemned all young meats, such as veal and lamb, as objectionable articles of food. He advocated animal food in the form of sausages as a nutritious form of diet, particularly for the labouring classses, the skin in which it was enclosed retaining all the essential juices. He differed from the remarks of Dr. Smith with regard to cheese, and was of opinion that the best was in the end the cheapest to the working classes. The most nutritive cheese was that which was made in Switzerland, though its high price in this country precluded its use by the poor. He submitted that the practical experience of mankind was the best criterion of the value of the different descriptions of food.

Dr. **Robert Dickson**, responding to the call of the chairman, said he had paid a great deal of attention to this subject, both theoretically and practically, and he was happy to say he had learnt a great deal from the paper read this evening. Of the relative value of white and brown bread opinions would differ, which was in a great degree owing to the diversity of tastes among mankind, which prevented an undue "run" upon any particular article of food. If the object was to afford nutriment to the system, he believed brown bread was inferior to white; if the object was to obviate a tendency to constipation, induced by a too sedentary habit, its use was essential. Dr. Lankester had very properly remarked that too little value had been attached to hydrogen in articles of food—whether animal or vegetable. There could be no doubt of the great utility of hydrogen as well as oxygen, to which scarcely any attention had been given in the paper. The hydrogen which existed in vegetable matters in the form of various hydro-carbons was of immense value. There were also other constituents in food of great importance. Nothing had been said of the great value of phosphorus, yet they all knew how essential that was to the animal system. It was alike important in health and in disease, and was an essential element to be taken into consideration in estimating the relative values of foods. Hence fish, which contained phosphorus, was a most excellent article of food, and if it were cheaper no doubt it would be more largely used by the lower classes. This was a question which required careful handling, for at present we were only upon the threshold of the subject, and he looked to science ultimately doing great things for mankind in this direction. In the meantime they were greatly indebted to Dr. Smith and others like him, who had acted as the pioneers in this important enquiry.

Mr. **Frank Buckland**, being called upon by the chairman, said having had the medical charge of a regiment of the Guards for some years, he had made it part of his duty to observe the effect of diet upon those fine specimens of Englishmen. He found young recruits from Ireland who had lived chiefly on potatoes all their lives, and were apparently strong, muscular men, after being put upon the ordinary diet of the English regiments, altered very much in appearance, and though they made flesh very considerably, they frequently broke down physically in going through their duties. The biggest boned men in the regiment were north country men and Scotchmen. That might be attributed to the oatmeal and also to the coldness of the climate. People from cold countries were invariably strong. Dr. Lankester had remarked upon the bad feeding of the army in former times. A great deal of the evil arose from the want of proper cooking of the food. A man was told off from the regiment to act as cook to his comrades, who probably had no previous knowledge of cookery; but now a school of cookery had been instituted at Aldershot for the instruction of men in those duties; and he could inform Dr. Lankester that the water in which the meat was boiled was not now thrown away. The ordinary rations of a soldier were ¾℔ of beef or mutton, 1℔ of bread, 1℔ of potatoes, with coffee and tea for breakfast and supper. The young recruit could not do his work upon that, and his extra requirements had to be provided out of his own pocket; but an old soldier, who was near the time of his discharge, throve very well upon those rations, and a man promoted to a corporal, who was exempted from hard duty, soon began to lay on fat, which proved that the dietary he had mentioned was suitable for the average of soldiers. There was a form of indigestion which the labouring classes called the water-brash, and he was informed that that complaint was curable in the majority of cases by simply leaving off drinking tea. Boiled meat sometimes had a tendency to produce this disease, and he would recommend those who gave away meat in charity, to have it previously roasted, by which plan the recipients were more benefited than when they were left to cook it in their own imperfect and often wasteful way.

The **Chairman** said they would all agree that the inquiry which had been instituted by the Privy Council was of the highest public as well as private importance, and, so far as it had been carried out, it appeared to him to have been very ably executed. Hitherto Dr. Edward Smith had been confined in his researches to the dietaries in use amongst the poor of the northern districts of England, of Scotland, and of some parts of Ireland. The observations he had made there were highly valuable. They indicated the superior efficacy of the simpler diets, those of oatmeal porridge and milk in Scotland, and of potatoes and butter-milk in Ireland. He had ascertained that in Scotland the country bred people, when they went into towns and obtained higher wages, and substituted tea and bread and butter for oatmeal porridge and milk, did not thrive so well upon this more expensive and stimulating diet. Public warning should be given of these results. It was highly important that these observations should be extended to the examination of the effects of the large variety of high and low dietaries in use in public institutions. There was great advantage in the observation of the effects produced on persons of similar ages and conditions, who might be weighed and examined. A German prince had lent to Liebig a body of soldiers to make experiments upon. He (the chairman) had promoted trials of different sorts of dietaries in prisons, and those trials might well be repeated under such scientific observations as Dr. Edward Smith was pre-eminently qualified to make. If the examination of the effects of the brown bread, as compared with the white wheaten bread, made by Dr. Edward Smith, were deemed conclusive, let the trials be repeated on other classes of persons. Each chief article of food ought to be separately tried. The late Mr. Aubin, the manager of the Central District School of London, who had had 30,000 children under his care, and was a good observer of foods, had found that there were great variations in the effects of various conditions of the same food; for example, oatmeal of inferior growth or condition produced eruptions on the skin and functional disturbance, whilst a good quality of growth was productive of good effects. It had fallen to him (the Chairman) to collect and compare, rudely as it might be, the effects of different public dietaries before chemical analysis had been brought to bear on foods. The dietaries collected from different parts of England, he found, when reduced to comparative weights, fell in the following scale, that was, the aggregate amount of solid food. The average that each class got was as follows:—

As agricultural labourers...................	122
As artizans of the highest wages	140
As paupers	150
As soldiers	168
As prisoners in goal	217
As convicts on board the hulks, or, as transported felons	237

To an allowance of ten pounds of meat a week in the stimulating climate of Australia, was added half-an-ounce of tobacco daily for the use of the convicts in Western Australia. It was at that time urged by medical authorities, and indeed was so still by many, that dietaries containing high stimuli beyond those got by the hard working honest population were necessary to sustain the health of the prisoners. He found that the quality of the diets, as containing more or less of animal food, was very much represented by the cost, and this varied from 1s. 2d. to 5s. and even 7s. per head per week. Now, it should follow, from the medical recommendations, that the health of the prisoners would rise in proportion. To determine this question he resorted to statistics. Taking 104 prison returns—which enabled a comparison of the twenty gaols where the expense and the quantity of the diet were the lowest; the twenty where the expense and the quantity of the diet were the highest, and the twenty where they were intermediate between the highest and the lowest—the results came out as follows:—

	Ounces of solid food week.	Cost per head per week.	Sick per cent.	Deaths per 1,000.
Twenty Lowest Prison Diets ...	188 ...	1s. 10½d. ...	3 ...	1½
Twenty Intermediate Diets ...	213 ...	2s. 4½d. ...	18 ...	3
Twenty Highest	228 ...	3s. 2d. ...	23½ ...	4

The results were objected to on the grounds that in some of the larger prisons, where the lower dietaries were adopted, the terms of imprisonment were shorter than in others. But those objections were met by the trial of the simpler dietaries in the same prisons, with the same classes of prisoners, with labour and without labour, for the like periods, where the like results appeared. No doubt changes of diet were beneficial, if not absolutely necessary, for persons in sedentary conditions or prolonged confinements, but variations with simple foods might be made to suffice, instead of augmentations in quantities, and in foods of the more stimulating and expensive character, beyond those which sufficed for the general population. Later experience was in the same direction. But sanitary conditions had yet to be taken into account in judging of the effects of dietaries. In one instance a severe epidemic broke out in an establishment for pauper children, which was proved to have been produced, not by insufficient diet, but by defective ventilation. In the case of the army, insufficient diets were assigned as the main or the sole cause of the mortality in the Crimea. The diets were augmented, and fever and epidemics were still rife; but when the air was purified by sanitary measures the health improved. The death rates in the army had been reduced in many instances by sanitary measures by one-half, without any important alteration of the dietaries. The effects of the prison dietaries, combined with improved sanitary conditions, were the most instructive. Soldiers were taken from the ranks, generally the worst conditioned men, where the death rate was seventeen in a thousand, and put into military prisons in Ireland, where the death rate was reduced to two and a-half per thousand, and the sickness in proportion. The dietary consisted of 8 ounces of oatmeal, 8 ounces of Indian meal, and 8 ounces of wheaten bread, with half a pint of milk at the three meals daily. There was no meat, no tea, no coffee, no beer, no tobacco, none of the stimuli which they got in the ranks, and their general health and strength was vastly improved. The medical authority who had observed the effect of the dietary for years declared he would make no alteration. But he (the Chairman) attributed a considerable proportion of the superior effects to the sanitary condition of personal cleanliness in addition to the element of improved ventilation. The Chairman mentioned a case of a general in Spain who had improved the health of his men by giving a bath daily, though their rations at the time were low. He urged the importance of personal cleanliness in the army. The importance of this had even been proved in the case of pigs. All evidence established the conclusion that, daily complete personal ablution would be productive of a large economy of food to the poorest of the population. In respect to the quantities of foods, he was of opinion that inasmuch as there were wide variations of natural appetite amongst men, there ought, as a general rule in public dietaries, to be one simple article of food allowed without any stint. The meeting would, he was sure, give a unanimous vote of thanks to Dr. Edward Smith for his able paper on this nationally most important subject.

The vote of thanks having been passed,

Dr. Edward Smith, in acknowledging the compliment, said he thought that some of the remarks of Dr. Lankester had been made without due deliberation. He had characterised the experiments he (Dr. Smith) had made as limited and vague. He could say, having been appointed upon the committee of the British Association, that the experiments were made continuously for a month upon four persons in Coldbath Fields Prison, and likewise upon the same number of persons in Wakefield Gaol, the examination of what passed from the body being chemical, and not merely microscopical, as Dr. Lankester had assumed. He therefore thought those experiments were not open to the objection that they were either limited or vague. With regard to the constituent of hydrogen in food, he had not undervalued this element, but had said that if he were treating of the nutritive value of food in a chemical aspect only, apart from any daily measure of the amount required by the body, he should add the free hydrogen also, since by its combination to form water within the body it must generate heat; but we had no means of ascertaining how much heat is produced and required by the body; neither could we ascertain how much of the water which leaves the body is generated in this manner, and how much is due to that which was taken as food. No doubt the mineral matters contained in the food were of the highest importance, and in mixed diets these were found. With reference to the remarks of Mr. Frank Buckland, as to the physical condition of the Irish recruits, he would say he was now engaged in a large inquiry, on behalf of the Government, to ascertain the exact amount of food taken by the different classes of the community in England, Ireland, and Scotland. At present he could not give the results of that inquiry, but in due time they would be published. The important question as regarded the Irish recruits was—not the potatoes, but the milk. The amount of milk taken by that class was generally large, and the great advantage to the muscular system was derived from this source, and not from the potatoes.

The Secretary announced that the next ordinary meeting would be held on the 20th January, 1864.

Proceedings of Institutions.

Greenwich Useful Knowledge Society.—A lecture was delivered here on the 8th Dec., by Dr. Yeats, of the Upper and Middle Schools, Peckham, on the subject of "Enterprise." It included a brief sketch of several living inventors, and a recommendation to all to peruse the list of premiums lately published by the Society of Arts. A vote of thanks to the lecturer terminated the proceedings.

Leeds Church Institute.—On the 26th Nov. the annual *soirée* was held in the Victoria Hall, which was crowded. Lord R. Cecil, M.P., presided, and was supported by the Vicar; Mr. Powell, M.P.; Mr. Collins, M.P.; Mr. Edward Akroyd, &c. The Chairman delivered an address on the "Benefits of Education," in the course of which he said there had been a great deal of unreasonable expectation on the part of the friends of education; they had expected that education would do things which nothing could do—that it would eradicate the tendencies to crime from the human heart. It was needless to say that their expectations had been disappointed. Crime had been as rife, perhaps more rife, in the present day than at the time when the educational movement commenced. That was not the benefit we had any right to look for. We had no right to expect that people would be less thieves or burglars than they were before. But that which we had a right to expect, and that in which our expectations had been justified, was, that the masses of the people, in moments of great trial, would show a truer appreciation of economical laws, and greater and more intelligent self-restraint. That they had done, and he maintained that the spectacle which this generation had witnessed amongst the operatives of Lancashire was the greatest proof of the success of education—of its value to the politician—its importance to the commonwealth—and its efficiency in rendering men better citizens and better men. In speaking of the prevalence of sensual pleasures amongst working men, he said the remedy was to provide people with some other means of enjoying themselves. If people were to read, and enjoy what they read—not only to use their intellects, but to enjoy those intellects—an enormous counter influence to vicious and sensual enjoyments was created. The great object which, he believed, education would serve among the masses, was not in preparing them to be great men, but in furnishing them with the means of wholesome and innocent enjoyment, which would occupy their hours of recreation.—The Rev. Canon Atlay, president of the Institution, presented a statement of its position. In 1861, when there was what he described as an "alarming crisis," they had to announce a deficiency of £51, but in the succeeding year the entire debt was liquidated, and £30 placed to the credit of the special book fund. The affairs of the Institution then began to wear a brighter aspect. During the present year their receipts had been larger than in any previous year, and at the end of December they hoped to have a balance of about £23. The number of members had also increased from 380, in 1860, to 409 in 1861, 543 in 1862, and in the present year to 593. The weak point was the classes, but this, he believed, was common to nearly all similar institutions. Mr. Powell, M.P., Rev. Canon Trevor, Mr. Akroyd, Mr. Collins, M.P., and other gentlemen, addressed the meeting.

Fine Arts.

Stained Glass Exhibition, 1864, South Kensington Museum.—The Executive Committee for the proposed Exhibition of Stained Glass, to be held in May next, in a portion of the recently completed cloisters of the South Kensington Museum, consisting of Mr. T. Gambier Parry, Mr. R. Burchett, with Mr. G. Wallis as secretary, have reported to the Department of Science and Art that, after considering all the claims sent, they recommend that window spaces be allotted to the following producers of stained glass:—Messrs. T. Baillie and Co.; H. M. Barnett, Newcastle-on-Tyne; J. Bell, Bristol; Chance, Brothers, and Co., Birmingham; Cox and Son; Davis and Barraud; R. B. Edmundson and Son, Manchester; Field and Allan, Edinburgh; J. A. Forrest, Liverpool; C. Gibbs, jun.; J. Hardman and Co., Birmingham; Heaton, Butler, and Bayne; Holland and Son, Warwick; Moberley and Lyon; Morris, Marshall, Faulkner and Co.; M. and A. O'Connor; Pilkington, St. Helens; J. Powell and Sons; W. Wailes, Newcastle-on-Tyne; Ward and Hughes; J. P. Warrington; W. Warrington, sen. The Committee remark that the whole of the space available, the varied dimensions of which had been forwarded to each of the invited exhibitors, was claimed, except a large space capable of being enclosed to any given form, with 50 feet high by 22 feet wide. This presents an opportunity for the exhibition of a large window under circumstances which rarely occur, and it is greatly to be desired that some artist in glass, having a suitable work in the course of execution for a church or cathedral, should undertake to occupy it during the period of exhibition, which will last during the summer months of 1864.

Commerce.

The Cotton Supply Association has during the last five years expended nearly £5,000 annually in promoting the growth of cotton in all parts of the world; it has distributed upwards of 600 cwts. of cotton seed, nearly 700 cotton gins, a quantity of ploughs and other agricultural implements, together with horse and cattle gear, and driving wheels for working gins where steam power could not be obtained. It has awarded prizes for the best treatises on the management of the cotton plant, and improved methods of cotton agriculture. Medals have also been given to successful cultivators. Extensive influence has thus been gradually acquired in all cotton-growing countries, whilst valuable information and assistance have been rendered. Various agencies have been called into existence to co-operate with the association; and through its representations different governments have been induced to afford special facilities for the cultivation of cotton, by exempting lands devoted to its growth from all taxes for a period of five years or more, by a liberal distribution of seed, and by royal commissions to afford all necessary aid and encouragement.

Cotton.—The official values of the cotton imports from 1858 to 1862 were as follow:—1858, £30,106,000; 1859, £34,559,000; 1860, £35,756,000; 1861, £38,653,000; 1862, £31,093,000. For the first eight months of the present year they have been officially valued at £26,862,000, and for the last four months of the year they may be taken at £23,000,000; total, £49,862,000. But for 1864, if present rates be maintained, the value would be £86,656,000, or nearly three times that of the imports of 1858, which included the American crop. As the amount given for the ensuing year may appear extravagant, the mode of calculation is given:—

	Bales.	lb.		
India	1,650,000	of 360	at 21d...	£51,975,000
Egypt	300,000	of 550	at 26d...	17,531,000
America	140,000	of 440	at 26d...	6,673,000
Turkey and Greece	140,000	of 300	at 23d...	4,025,000
Brazil	190,000	of 190	at 26d...	3,911,000
China	200,000	of 200	at 20d...	3,334,000
Italy, &c.	15,000	of 440	at 23d...	632,000
Other sources	30,000	of 200	at 23d...	575,000
				£88,656,000

It is true that a portion of this amount will be refunded from re-export, but in the meantime the capital to carry this large trade has to be found in this country, and the evil is exaggerated by the proportionately large capital involved in the manufacture and export of cotton goods to distant countries. In the provinces of Corrientes, Entre Rios, and Santa Fe, millions and millions of cotton plants are at present over the earth, with every prospect of doing well. Paraguay has also set a noble example in this new industry. With a good season, 5,000 bales of clean cotton will be exported this season from the River Plate. Such is the encouragement given in some instances that the provincial governor has not only relieved cotton plantations from local taxation but has actually offered farms of land, in fee, gratis to all who applied them to cotton planting.

Obituary.

The death of the **Earl of Elgin**, which occurred in India on the 20th November, is recorded with deep regret. He was the eldest son of the Earl of Elgin, who brought over the well-known marbles now in the British Museum. He was born in 1811; in 1841 he was elected M.P. for Southampton; in 1842 he went out as Governor of Jamaica, where he remained four years; he was then appointed Governor of Canada; in 1846 he married a daughter of the Earl of Durham; in 1857 he was sent as Ambassador to China; on his return he was appointed Postmaster-General, but again went to China in 1860, the French Ambassador, Baron Gros, accompanying him in his mission. He returned early in 1861, and was soon after appointed Governor-General of India, where he remained till his death. He presided at the 107th annual dinner of the Society of Arts, in 1861.

James Duffield Harding, the well-known water-colour painter, died on the 4th of December, at Barnes. He was born in 1798. His father, who was also an artist, was a pupil of Paul Sandby, and his own taste was principally matured by Samuel Prout. He was also a careful student of Turner's "Liber Studiorum." In early life he became a pupil of an engraver. In 1818, he received the silver medal of the Society of Arts for "an original landscape." He became a teacher of drawing, and in 1830 visited Italy, where he made sketches on coloured paper, which led to the extensive use of that material. In 1836 he published "Sketches at Home and Abroad;" and in 1842, "The Park and the Forest." In 1861, his "Selections from the Picturesque" appeared; he having also published, at various times, "Lessons on Art," "Guide and Companion to 'Lessons on Art,'" "The Principles and Practice of Art," and other works, and having also illustrated several annuals. He was one of the principal members of the Old Society of Painters in Water Colours, but having some years ago taken to oil painting, he desired admission to the Royal Academy, and in obedience to the rule which forbids a candidate from being a member of any other society, he left the Old Water Colour Society. He was, however, not admitted into the Academy, and after some time he joined his old Society. He was elected a member of the Society of Arts in 1847.

Notes.

Rifle Conference.—A conference will be held on Tuesday, Wednesday, and Thursday, January 12, 13, and 14, 1864, in the Halls of King's College, London, the object being to enable those who are interested in rifle shooting to consider the management of rifle matches, prize meetings, and other competitions; to impart information as to the apparatus and weapons employed; the targets, marking, and scoring; and the various adjuncts of rifle shooting, as well as to discuss the arrangements and regulations which have been approved by experience, or are suggested as further improvements. A committee of experienced shots has been formed, the chairman being Captain MacGregor, of the London Scottish; the vice chairman, Captain Woods, of the Central London Rifle Rangers; and the hon. secretary, Lieut. Cunningham, of the 18th Middlesex (Harrow). The committee will endeavour to embody the information obtained and to sum up the results, in a published report, which will be submitted to the National Rifle Association, with a view to aid that body in its efforts to make rifle practice more popular and more effective. A room will be provided for exhibiting such models, machinery, drawings, plans, and instruments, as may require to be explained.

Exhibition Building.—An absurd statement has been going the round of the daily papers to the effect that the recent gales have blown all the glass out of the domes. The glass was removed from the domes very soon after the Parliamentary decision against the purchase of the building, and the recent gales caused no damage of any kind to it. It is expected that the scaffolding in the eastern dome will be sufficiently advanced to commence the removal of the gilded spire in the course of three weeks.

Correspondence.

Electric Regulators.—Sir,—Mr. Ladd's remarks call for reply. No one has questioned the excellence of Mr. Holmes's very beautiful electric regulator. *The* question raised (and one not to be blinked by any amount of self-assertion) was—Could not a simpler form of lamp be designed, that would be less liable to injury in the hands of rough lighthousemen? I therefore called attention to two forms of electric regulators that meet this demand, viz., Professor Way's and Dr. Squire's, and I venture to assert that the latter gentleman is thoroughly conversant with the construction and practical manipulation of the various known arrangements, having made automatic electric lamps a hobby; and he has invented more ingenious modifications and simplifications in this direction than any one I am acquainted with, but, having no monetary interest at stake, he has taken no pains to bring his inventions before the scientific public. If the battle of the electric lights at the Polytechnic was not *professedly* "a competitive trial" it was so virtually—but it was a drawn fight, for no difference could be observed in the performance of those brought into action, and Dr. Squire's burnt as steadily as any of the others during the time the batteries were in working order, but towards the end of the evening I had to give up my terminals for "the submarine light," exhibited in the tank below. On again making connection I found a falling off in the battery supply. I leave it to your readers to determine whether Mr. Ladd's criticism is a fair one, for an experienced and unprejudiced eye ought to have discerned that the kind of unsteadiness he alluded to was not attributable to a defect in the mechanical part of the arrangement. Any way, I have sufficient confidence in Dr. Squire's regulator to offer to place it for trial, in the hands of any competent person, untrammelled by trade interest.—Samuel Highley.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...R. Asiatic, 3.
Ethnological, 8. 1. Mr. Francis Galton, "On the First Steps towards the Domestication of Animals." 2. Rev. G. Rome Hall, "On the British God Mogon and the Religion of the Northumbrian Celts."
Sat. ...Royal Inst., 3. Prof. Tyndall, F.R.S., "On Electricity at Rest and Electricity in Motion." (*Juvenile Lectures.*)

Patents.

From Commissioners of Patents Journal, December 11*th.*

Grants of Provisional Protection.

Animal and vegetable substances, preserving—2951—D. W. Rea.
Bags, travelling—3004—J. E. and E. H. Blundon.
Balloons—2959—W. E. Newton.
Beetroot, manufacture of paper, etc. from—2967—L. Accarain.
Blond, joined—2960—J. Sibert.
Bolts, nuts, etc., machinery for making—2936—F. Watkins.
Boring rock, etc.—3000—E. W. James.
Braiding machines—2957—R. Furnival.
Braiding machines—2942—W. Bestwick.
Brick-making—2944—P. Bawden.
Brick making machinery—2932—W. Williams.
Cab indicators—2989 - P. Gaskell.
Carriages—2907—E. Christmas.
Carriages and wheels—2994—A. Etienne.
Casks, stopping holes in—2905—J. Collyer.
Chaff-cutting machinery—2993—T. Lane.
Coal, washing small, etc.—2901—I. Francis.
Colouring matters—2739—R. Smith.
Cottages—2867—E. W. Elmslie.
Cotton gins—2915—B. Dodson, E. Barlow, and P. Knowles.
Cotton machinery—2906—R. Walker, J. Walker, and B. Brown.
Cotton, mills for cleaning—2857—J. Harrison.
Cotton, rollers used in spinning, etc.—2914—E. Marwood.
Door knobs—2862—J. Hulse and J. Lawrence.
Door springs, etc.—2996—G. A. Thompson, sen. and jun., and J. Latham.
Electric telegraphs—3006—H. Wilde.
Envelope making—3027—A. W. Haley, A. Bingham, and R. Webster.
Extracting essences and perfumes, etc., also bleaching and purifying oils and fats—2987—H. Hirzel.
Fan blowers—2924—W. E. Newton.
Fibre-cleaning machinery—2958—W. E. Newton
Fire escapes—2965—M. Power.
Fire-proof floor or roof—2929—T. Turner.
Fitting together articles—2992—E. Ironmonger.
Floors of bridges, houses, etc.—2935—E. Finch.
Fuzes and shells for ordnance - 3005—E. M. Boxer.
Gas generating, when made by passing air over volatile oils, and improving its heating and illuminating qualities—3023—W. Wilson.
Gas meters—3017—G. Glover.
Gas meters—2912—G. Rait and J. Winsborrow.
Gas, purifying, etc.—2971—R. Laming.
Gun-boats, etc.—2922—A. McLaine.
Guns, mounting, etc.—3016—E. A. Inglefield.
Guns and projectiles—2999—J. Chalmers.
Hydro-carbons, furnaces for the manufacture of—2981—F. Page.
India rubber, cutting strips of, etc.—2985—J. Clark.
Ink regulator—3021—G. Macfarlane.
Insects, destroying—2988—S. and T. Smith.
Intermixing dry, semi-fluid, or aqueous materials, etc., machinery for—2947—T. Carr.
Iron ores, treatment of—2903—J. Kirkham.
Letter and music clips—2928—C. E. Wright.
Lighting and heating—3015—W. Clark.
Lighting and ventilating—3033—J. Cutler.
Looms—2969—H. B. Barlow.
Looms for elastic fabrics—2984—J. Clark.
Looms for elastic fabrics—2986—E. Gardner.
Malt, mashing—2939—D. W. Hamper.
Marine fog signals—2962—C. L. Daboll.
Marking patterns upon skirts, for sewing and embroidering—2972—J. Thorpe.
Meat, etc., preservation of—2949—G. W. Yapp.
Metallic drums, kegs, etc.—2933—D. Cope.
Metals, presses for cutting—2964—T. Wilson.
Mining machinery—2786—R. H. Philipson and J. Dees.
Mules for spinning - 3019 - T. Mallinson.
Oil cans, etc.—2911—W. B. Hodson.
Oils, expressing—3018—J. Thom.
Paper pulp—2931—F. Fenton.
Paper spool tubes—2983—C. Crabtree.
Paraffine, etc.—2963—G. Parkin.
Photography—2954—G. Davies.
Pianofortes, hammers for—2918—A. H. Ferry.
Presses—2946—E. B. Wilson and J. Imray.
Pressing and ironing garments—2961—P. Tait.
Printing floor cloths, carpets, etc.—2952—W. Howlett.
Plough—3011—W. E. Gedge.
Rags, discharging colour from, etc.—2980—T. Gray.
Railway car springs—3007—P. G. Gardiner.
Railway carriages—2920—G. S. Kirkman.
Railways—2908—W. Symons.
Raising and forcing fluids—2975—J. Nadal.
Reefing and furling sails—2910—J, Colling and D. G. Pinkney.
Rotatory engines—2956—J. H. Johnson.
Scaling ladders, etc.—2923—G. Fawcus.
Sewing machines—2982—J. and D. Bateman.
Sewing machines—3020—S. B. Cochran.
Sewing machines, driving—2955—J. Lewis.
Sheeting piles, wrought iron—2909—R. Gooch.
Ships and other lift pumps—2968—J. H. Wilson.
Ships, coating bottoms of—2974—J. Baker.
Ships, coating the bottoms of—2945—J. Smith.
Ships, coating, telegraph cables, etc.—3012—J. G. Redman and G. Martin.
Ships of war—2995—A. Albini.
Ships, sheathing iron—3014—R. Turnbull.
Shirt collar—2976—J. S. Jarvis.
Sluice cocks and their connections—3003—C. Pontifex.
Steam boilers—2846—E. Hargraves.
Steam boilers, incrustation in—2913—J. Seward and H. Smith.
Steam engines - 2927—J. H. Johnson.
Steam engines—2898—J. Elder.
Steering apparatus—3013—H. Lumley.
Stoves, hot-air—2919—J. J. Hays.
Straining wire for fences - 3031—J. Harper.
Straw, thrashing and reeding—2921—T. Brinsmead.
Sugar refining—3010—G. J. Doddrell.
Sulphur from alkali waste, separating—3909—B. Jones.
Tapes, arranging etc.—2940—M. B. Westhead.
Testing the strength of materials—2970—D. Kircaldy.
Time register, self-acting—2997—W. Campion and G. and A. Wilson.
Umbrellas, frames for, etc.—2977—J. Chesterman.
Vermin traps—3008—R. Brailsford.
Watches, independent centre seconds—2990—E. Bevan and W. S. Weare.
Water, obtaining fresh, from sea water—3002—J. M. Ollis.
Water-closet traps, etc.—2973—J. Simmonds.
Water-closets and urinals—2991 - C. Cordon.
Winding yarns—2979—W. C. Brocklehurst, and J. and J. Creighton.
Windlasses—2904—E. Walker.

Invention with Complete Specification Filed.

Fret saws—3059—H. A. Bonneville.

Patents Sealed.

1348. E. Ironmonger.

From Commissioners of Patents Journal, December 15*th.*

Patents Sealed.

1462. J. Johnson and W. Braithwaite.
1482. R. Blackburn.
1498. R. W. Gordon.
1505. J. Lightfoot.
1506. J. G. Jennings and M. L. J. Lavater.
1508. J. Steele and W. Mason.
1510. W. Neill, jun.
1511. J. C. Onions.
1512. R. A. Brooman.
1519. F. de Wylde.
1527. D. Barker.
1537. A. Morel.
1538. A. Morel.
1569. W. Clark.
1582. W. L. and T. Winans.
1584. W. L. and T. Winans.
1585. E. Brooks.
1596. A. E. Brae.
1612. J. Griffiths.
2388. H. Haigh and R. Heaton.

Patents on which the Stamp Duty of £50 has been Paid.

3004. B. G. George.
3008. G. Davies.
3027. R. Davison.
3038. J. Townsend and J. Walker.
3084. G. Davies.
3031. W. E. Newton.
3079. W. E. Newton.
3096. E. Barlow, J. Newhouse, and F. Hamilton.
3150. W. Clark.
3051. G. S. Harwood.
3057. J. Casson.
3129. G. Hadfield.
3054. A. Kyle.
3071. J. Chubb and E. Hunter.
3039. A. Verwey.

Patents on which the Stamp Duty of £100 has been Paid.

2950. J. T. and E. P. Wright.
2926. W. and T. Storey.
2940. W. Lund.